

## A Lower Miocene squalodontid from the Ashiya Group, Kyushu, Japan

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**Abstract** An upper jaw with three molars of a squalodontid is discovered from the Lower Miocene Ashiya Group, North Kyushu, Southwest Japan. A new species, *Metasqualodon symmetricus* is proposed based on the specimen. The teeth bear accessory cusps on either side and strial ornamentations on the lingual surface of crown. Similar features are seen in the squalodontid as *Metasqualodon harwoodii* (SANGER), reported from the "Oligocene" of Australia (SANGER, 1881). The Japanese species are characterized in more symmetrical arrangement of the accessory cusps.

### Foreword

In July of 1981, the author found a fossil bone, which is included in calcareous sandstone concretion, on an exposure in the shore of the Umashima Island, to the north of Kokura, Kitakyushu City. In the fall of the year, the fossil bone was cleaned up revealing the upper jaw with three squalodontine molars. The geology of the location is sandstone member of the Lower Miocene Ashiya Group, especially correlated to the Yamaga Formation in the group. The formation yields abundant molluscan fossils such as *Glycymeris cisshuensis* MAKIYAMA, *Turritella infralirata* NAGAO etc. Cetacean fossils from the Ashiya Group are already reported by several authors, such as *Patriocetus* sp. by MATSUMOTO (1923) and a vertebra by HASEGAWA and HOJO 1965. But there have been no squalodontid teeth reported not only from the district but also from whole Japan. Therefore, the present report is the first record of the occurrence of shark-toothed whales from Japan.

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## Systematic Description

### Family Squalodontidae

#### Genus *Metasqualodon* HALL, 1911

Type species; *Zeuglodon harwoodii* SANGER, 1881, *Proc.*

*Linn. Soc. New South Wales*, 5, pt. 3, 298-300.

#### *Metasqualodon symmetricus*, n. sp.

Holotype; Right premaxilla and maxilla with three upper cheek teeth.

KMNH VP 000,004

Diagnosis; Small squalodontid bearing molars with accessory cusps on both anterior and posterior cutting edges. Accessory cusps arranged symmetrically against main cusp.

Description; right upper jaw preserved.

Maxilla triangular in section, with slightly convex dorsolateral, convex medial and palate faces. Maxilla contacts with premaxilla making a fullow on dorsolateral face of the rostrum. The fullow curves laterally to the lateral margin of the rostrum. In the palate face the suture between maxilla and premaxilla runs posteriorly and medially from alveolar fullow. The palate plane of the maxilla concave in the posterior-lateral part, whereas convex in the medial part. A foramen opens on the palate plane of the maxilla at the place of as anterior as the 3rd cheek tooth. Premaxilla partly preserved with dorsal narrow face and medial face.

Three cheek teeth preserved. Teeth with triangular crown. Both anterior and posterior cutting edges with distinct accessory cusps. Numbers of the accessory cusps are as follows;

	anterior cutting edge	posterior cutting edge
3rd cheek tooth	4	4
4th cheek tooth	4	5
5th cheek tooth	5	6

Cheek teeth with rugose ornamentations on lingual surface at the basal part of the crown. Crown with medial notch at base. Notch distinct in buccal side but weak in lingual side. Third cheek tooth partly broken; higher than antero-posterior width. Fourth and fifth cheek teeth perfectly preserved, gradually widened posteriorly. Cheek teeth slightly worn on the apices of accessory cusps. In the fourth cheek tooth, an accessory cusp anterior to the main cusp is worn with oblique lingual occlusal facet. Two accessory cusps posterior also worn. In the fifth cheek tooth, two anterior and two posterior accessory cusps

are worn simultaneously. Cheek teeth with two roots of imperfectly separated.

Anterior to the cheek teeth preserved, six alveolar openings are observed. Among them, fourth is for canine judging from the suture of maxilla and premaxilla. Three alveolae for incisors are round to slightly ovate in section. Alveola for medial incisor observed on the broken surface of the premaxilla. Alveola for canine also ovate, opened anteriorly. Alveola for first cheek tooth ovate. For second cheek tooth also ovate but with weak central constriction. Alveola for sixth cheek tooth separated to two openings. Along the lingual side of the alveolar row, a furrow running.

Measurements (in mm);

total length as preserved	176
length of maxilla as preserved	146
length of premaxilla as preserved	116
maximum width of maxilla	43.4

Followings are measured on alveolae;

- a; length from anterior margin of maxilla to anterior margin of alveolar opening.
- b; medial-distal diameter of alveola
- c; lingual-buccal diameter of alveola

alveola	a	b	c
I <sup>2</sup>	29±	9±	9.0
I <sup>3</sup>	14.6	10.8	8.3
C	6.0	12.4	8.9
B <sup>1</sup>	25.9	12.4	8.2
B <sup>2</sup>	47.3	12.0	7.1
B <sup>3</sup>	61.2	14±	8.4
B <sup>4</sup>	79.7	16±	11.2
B <sup>5</sup>	99.8	17±	11.1
B <sup>6</sup>	121.0	17.1	8.1

Followings are measured on crowns;

- d; medial-distal diameter of crown
- e; lingual-buccal diameter of crown
- f; crown height
- g; apex to notch of crown at buccal side
- h; medial-distal length of crown base

cheek tooth	d	e	f	g	h
3rd	15.0	7.1	16.1+	12.0+	11.5
4th	17.6	9.2	17.6	12.7	12.8
5th	17.6	8.5	16.0	12.4	14.5

## Remarks and discussion;

The present species is characterized in followings;

- (1) small squalodontid with smaller to medium size.
- (2) cheek teeth with two roots of imperfectly separated.
- (3) anterior and posterior cutting edges with accessory cusps.
- (4) accessory cusps arranged symmetrically.
- (5) directions of accessory cusps are divergent from the axis of the crown.
- (6) posterior to the canine, at least six cheek teeth existed, and not so much more.

KELLOGG (1923) discussed "shark-toothed whales" on about 50 species. He also presented a key in the characters of teeth of these cetaceans, although "realizing that the teeth of cetaceans are not especially adapted for the formulation of a key". According to the KELLOGG's key, the present material shows similarity to *Metasqualodon harwoodii*, reported by SANGER from the "Oligocene" of Austraria. The holotype of *Metasqualodon harwoodii* has been figured in the SANGER's report (1881), which is a molar with broken roots and anterior four and posterior six accessory cusps. The Ashiya material shows smaller size of the crown and more symmetrical arrangement of the accessory cusps. Also, difference is observed in the directions of the accessory cusps. Among the teeth of Ashiya specimen, the fourth is most closer in shape of the holotype of *Metasqualodon harwoodii* (SANGER).

From the Ashiya Group, MATSUMOTO (1923) reported *Patriocetus?* sp. from the Sakamizu Formation without illustration nor description. HASEGAWA and HOJO recorded a vertebral bone of a whale from the same formation without giving a classification. Although many other cetacean remains are known from the Yamaga Formation and its correspondences, they have not been reported because of their fragmental occurrences. The existence of shark toothed cetacean in the

Table 1. Fossil List of the Ashiya formation (1982. 7.)

Mammals		
	<i>Metasqualodon symmetricus</i> , n. sp.	Umashima Isl.
	squalodontid, gen. et spp. indet.	Umashima Isl.
		Hikoshima Isl.
	<i>Patriocetus?</i> sp. (MATSUMOTO 1923)	Tominohana?
	<i>Mauicetus?</i> sp. (OKAZAKI, oral)	Wakaba
	<i>Amynodon?</i> sp. (unreported)	Umashima Isl.
Aves		
	pteropterid, spp. (HASEGAWA <i>et al.</i> 1979)	Umashima Isl.
		Ainoshima Isl.
		Hikoshima Isl., etc.
Reptiles		
	Chelonia, gen. et spp. indet. (unreported)	Umashima Isl.
	<i>Trionyx</i> sp. (unreported)	Ainoshima Isl.
	<i>Geoemyda takasago</i> MATSUMOTO (1929)	unknown

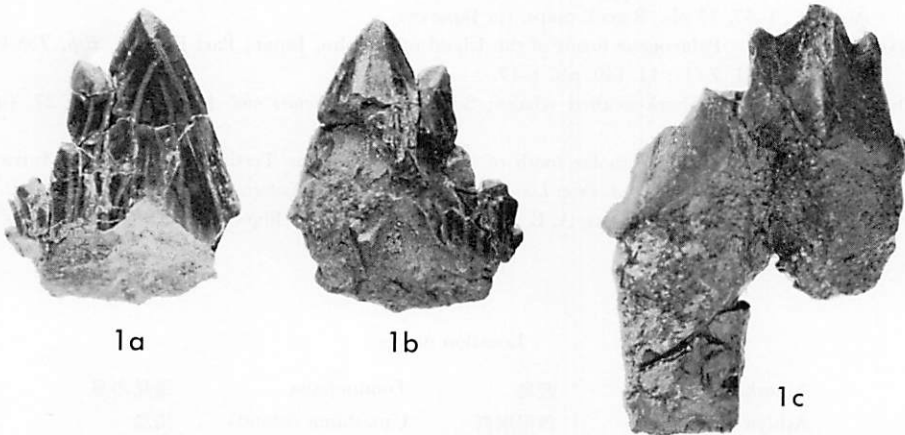
Ashiya Group has been modestly suggested by HASEGAWA (in HASEGAWA *et al.* 1979) as "occurrence of whale such as *Zeuglodon* (p. 52). His presumption is based on an incomplete tooth from the Hikoshima, Shimonoseki City, Yamaguchi Prefecture. Furthermore, a broken tooth was collected in March, 1979 by Mr. A. FUJII, through geological survey of the Kitakyushu Museum of Natural History, from the northern coast of the Umashima Island. These two teeth are recorded below and treated as squalodontid, gen. et sp. indet. in the table 1.

Including those squalodontid whales, the Ashiya Group has yielded mammalian, avian and reptilian fossils as shown in the table 1. Lower Miocene Ashiya Stage is characterized by those vertebrates of mainly coastal or pelagic habitat, with a small amount of lucustrine or swamp animals. Among them, pelagic mammals, e.g. cetaceans are interesting because they have closer species in the southern hemisphere. Analysis of the assemblage should be a problem for future, unless many of the species have not been studied and described.

**? *Metasqualodon symmetricus*, n. sp.**

(Textfig. 1a, 1b)

Nishiyama specimen; A fragmental cheek tooth, found at coast of Nishiyama, Hikoshima Island, Shimonoseki City, collected by Mr. K. NAKAGAWA and others. Crown with posterior four accessory cusps is preserved. Anterior cutting edge poorly preserved, at least with longer cutting edge between main cusp to the uppermost accessory cusp than that of posterior. Size and shape of the Nishiyama specimen is similar to the holotype of *Metasqualodon symmetricus* (KMNH VP 000,004).



Textfig. 1. Squalodontid teeth from the Ashiya Group.

1a, 1b: Nishiyama specimen       $\times 2$

1c: Umashima fragmental tooth (KMNH VP 000,005)       $\times 2$

**squalodontid, gen. et sp. indet.**

(Textfig. 1c)

Umashima fragmental tooth; (KMNH VP 000,005) Only basal part of crown with separated roots, found at northern coast of Umashima Island, Kitakyushu City, by A. FUJII. One accessory cusp, presumably anterior, is preserved.

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**Location names**

Ainoshima (island)	藍島	Tominohana	遠見の鼻
Ashiya (formation)	芦屋層群	Umashima (island)	馬島
Hikoshima (island)	彦島	Wakaba	若葉
Kokura	小倉	Yamaga (formation)	山鹿累層
Sakamizu (formation)	逆水累層		

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Plates 6-7

### **Explanation of the Plate 6**

**Figs. 1–3.** *Metasqualodon symmetricus*, n. sp.

**Holotype;** KMNH VP 000,004. right upper jaw with three cheek teeth.  
**nat. size.**

- 1;** dorsal view
- 2;** ventral view
- 3;** lateral view





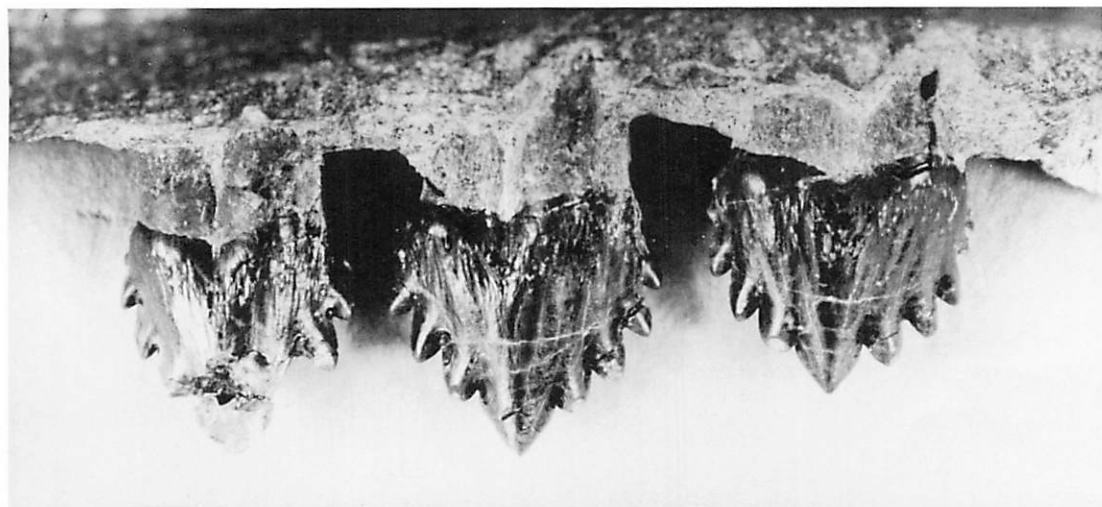
**Plate 7**

### **Explanation of the Plate 7**

**Figs. 1–3.** *Metasqualodon symmetricus*, n. sp.

Holotype; KMNH VP 000,004. right upper cheek teeth in close photo.  
× 2

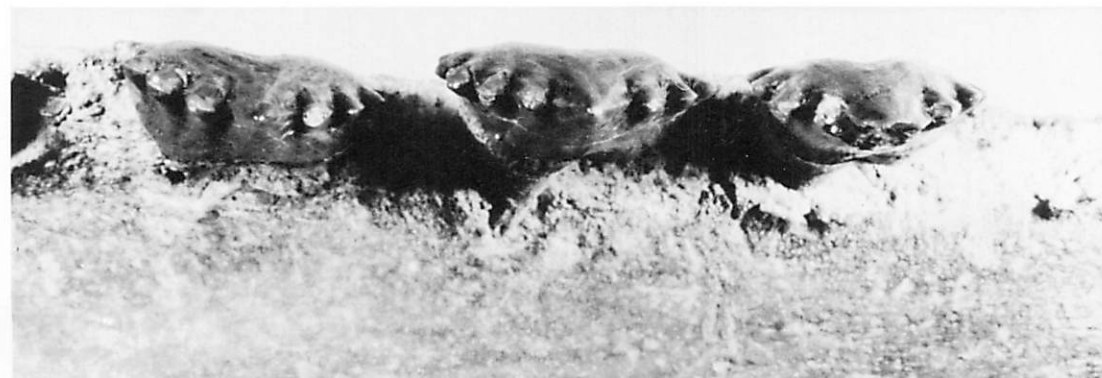
- 1; lingual view
- 2; buccal view
- 3; occlusal view



1



2



3